Predictability of outlier forecast error using TIGGE ensemble forecasts

Fumichika Uno (1), Hideaki Ohtake (1), Takashi Oozaki (1), and Yoshinori Yamada (2)

(1) National Institute of Advanced Industrial Science and Technology, Research Center for Photovoltaics, Japan (uno.fumichika@aist.go.jp), (2) Meteorological Research Institute, Japan Meteorological Agency

Numerical weather prediction (NWP) model is used in the day-ahead forecast of solar radiation for photovoltaic power systems. Forecast datasets are utilized for other models as an input data. Kato (2015) launched a competition for solar radiation forecast with dynamical and statistical forecast models. The all models estimated similar large bias (over or underestimate) of solar radiation in several cases because of using single NWP model forecast as model input data. These results indicate the need for ensemble forecast, particularly multi-NWP center forecast. Ensemble mean of solar radiation decreased the forecast error (Thorey et al. 2015), and ensemble spread had relationship of forecast error (Zacharov and Rezacova 2009). However, there are a few researches regarding a benefit of ensemble mean and spread for renewable energy field. Then, this study investigated the evaluation of outlier forecast error case in day-ahead forecast using ensemble mean and spread in Kanto region in Japan.

We used deterministic forecast (CTL) and ensemble forecast, and selected four NWP centers (JMA, ECMWF, UKMET, and NCEP). These datasets have been archived on TIGGE (The International Grand Global Ensemble) project. We evaluated reference index of outlier that compared the operational forecast with the surface observation.

From our analysis, extreme outlier cases (over 90 percentile) of operational forecast overestimated more than 16% on observed daily solar radiation in 2014. In maximum outlier case, the forecast accuracy of solar radiation depended on reproducibility of moving low and its surrounding clouds. CTL forecast biases were larger than ensemble mean forecasts in a number of outlier cases. The ensemble spread of the outlier cases had positive correlation in daily forecast error over 90-percentile. However, the correlation coefficients decreased with decreasing percentile rank. These results indicate that ensemble spreads were useful reference index to predictability of extreme outlier cases of solar radiation forecasts.